Small Business Innovation Research/Small Business Tech Transfer

In-Situ Electrospray Capture of Organic Bearing Particulates from Alien Water Fountains, Phase I



Completed Technology Project (2018 - 2019)

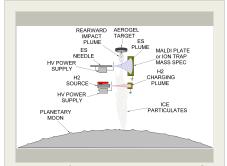
Project Introduction

NASA has need for technologies that can enable sampling from water jets, such as those observed emanating from the moon Enceladus and from the moon Europa. We propose to leverage past observations of the ability of electrospray ionization to capture and concentrate polar or polarizable trace species without damage, and combine that knowledge with recent discoveries in developing a hypervelocity ice-gun for NASA studies aimed at ice grain capture simulations. The phase I effort will focus on using the ice gun we created under prior NASA support, and add a cold plasma curtain to precharge an incident ice grain, and then add a novel electrospray element that we believe will enable in-situ organic analysis capability previously unattainable on board a spacecraft using existing NASA mass spectrometer hardware. Incident ice grain impacts into aerogel create a rearward plume of water vapor that may contain a high percentage of trace organic species. Using a cross-current electrospray source, these species may be charged to form multiply charged ions capable of being interrogated in-situ using a mass analyzer, while preserving aerogel impact samples for a return mission. This proposal endeavors to address one of the major concerns in any particulate impact-capture mission, is the potential loss of valuable samples entrained in aerogel. In addition, the long flight time back to Earth results in significant potential discovery delays. With the proposed technology, NASA can now perform in-situ organic analysis of incident ice grains in near real-time, and have impact samples retained for a return mission for additional study on Earth.

Anticipated Benefits

The applications of the proposed technology for NASA include the means to employ mass spectrometry in more applications than has been the case in the past, because with the creation of multiply charged ions rather than singly charged species, existing mass analyzers can be employed to look for the presence of organic molecules, without increasing analyzer upmass, size, or power requirements.

For Non-NASA applications, the technology being offered in this proposal include the potential for new methods of ambient pathogen capture and soft ionization for mass spectrometric analysis. In addition, other applications may include non-organic polar molecule charging suitable for thin layer deposition, chip fabrication, and other semiconductor uses.



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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Туре	Location
Connecticut Analytical	Lead	Industry	Bethany,
Corporation	Organization		Connecticut
Jet Propulsion	Supporting	NASA	Pasadena,
Laboratory(JPL)	Organization	Center	California

Primary U.S. Work Locations		
California	Connecticut	

Project Transitions

July 2018: Project Start



February 2019: Closed out

Closeout Documentation:

• Final Summary Chart(https://techport.nasa.gov/file/141112)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Connecticut Analytical Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Joseph Bango

Co-Investigator:

Joseph Bango

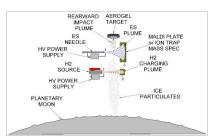


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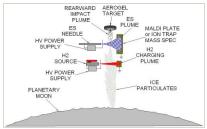
Completed Technology Project (2018 - 2019)

Images



Briefing Chart Image

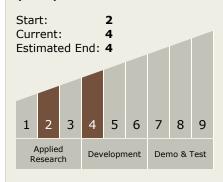
In-Situ Electrospray Capture of Organic Bearing Particulates from Alien Water Fountains, Phase I (https://techport.nasa.gov/imag e/132073)



Final Summary Chart Image

In-Situ Electrospray Capture of Organic Bearing Particulates from Alien Water Fountains, Phase I (https://techport.nasa.gov/imag e/128756)

Technology Maturity (TRL)



Technology Areas

Primary:

- TX04 Robotic Systems
 TX04.2 Mobility
 - ☐ TX04.2.1 Below-Surface Mobility

Target Destination

Others Inside the Solar System

